

# Foam Recovery and Destruction



California Air Resources Board  
AB 32 Climate Change Early Action Measure  
Background for the Working Group Pre-Meeting  
May 6, 2008

# Outline

- Background
- Insulating Foam Included as GHG Sources
- Emissions and Trends
- Potential Control Strategies
- ARB-Funded Research
- Existing Data Gaps

# Background

- Foam Recovery & Destruction Program Recommended as Early Action Measure:
  - High-Global Warming Potential (GWP) Greenhouse Gas (GHG) insulating poly foams are potentially in every building, refrigerator, and freezer
  - Foams are a large source of gases that are greenhouse gases and ozone-depleting substances
  - Reduction of emissions from foam will benefit efforts to mitigate climate change and stratospheric ozone depletion

## Sources of High-GWP GHG Foam Banks

- Sources of High-GWP GHG Foam Banks:
  - Building insulation (rigid poly foams) – 64%
  - Appliances (refrigerators, freezers) – 29%
  - Commercial refrigeration units – 4%
  - Transport refrigerated units – 2%
  - Miscellaneous (water heaters, picnic coolers) – <1%



# Greenhouse Gases in Insulating Foam

## Transition of High-GWP GHGs used in Foam

Foam Gas	Dates Used	ODS	GWP
CFC-11	1930s-1995	Yes	4,600
HCFC-141b	1996 – now (from stockpiles)	Yes	700
HFC-134a	2000 – now	No	1,300
HFC-245fa	2005 - now	No	950

Source: IPCC/TEAP, 2002. Safeguarding the Ozone Layer and the Global Climate System

## Foam Emission Pathways

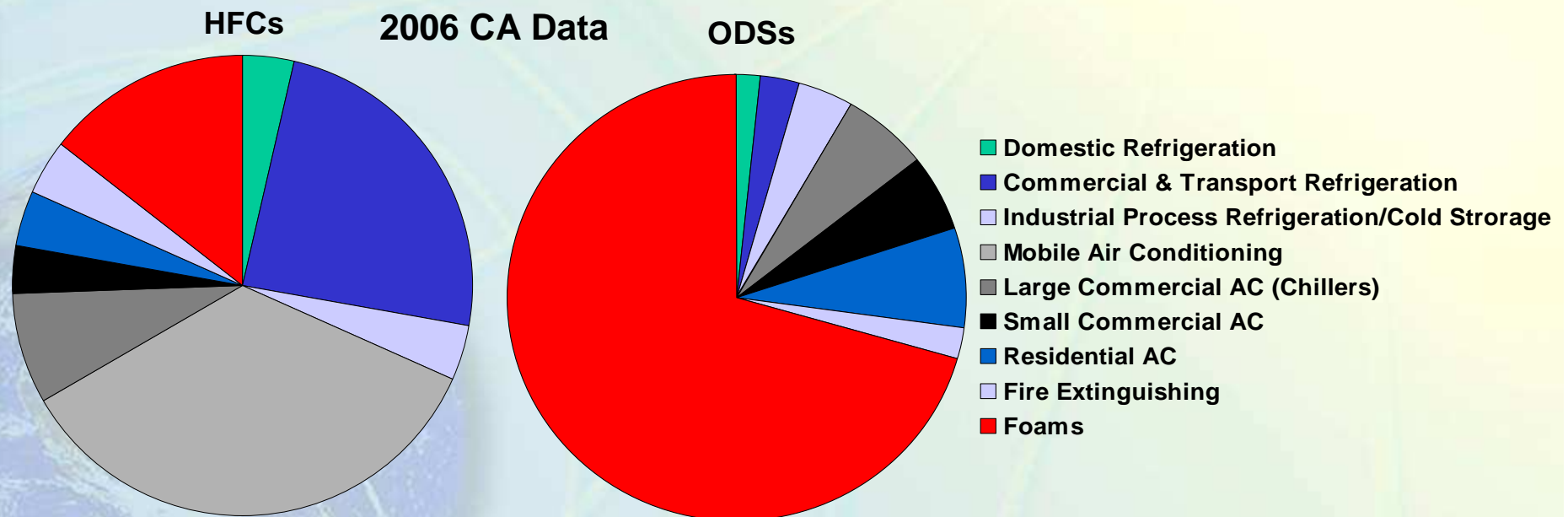
Process/Location	Loss of Gas	Note
Manufacture	4—100%	Each foam type unique
During Life of Insulation	0—2.5% per year	Average loss 1% per year
Recycling/Disposal	Up to 25%	Shredding/breakage
Landfilled	0.5—2.5% per year	Average loss 1% per year

Source: USEPA, U.S. High GWP Emissions 1990-2010: Inventories, Projections and Opportunities for Reductions, EPA 000-F-97-000, June 2001 .

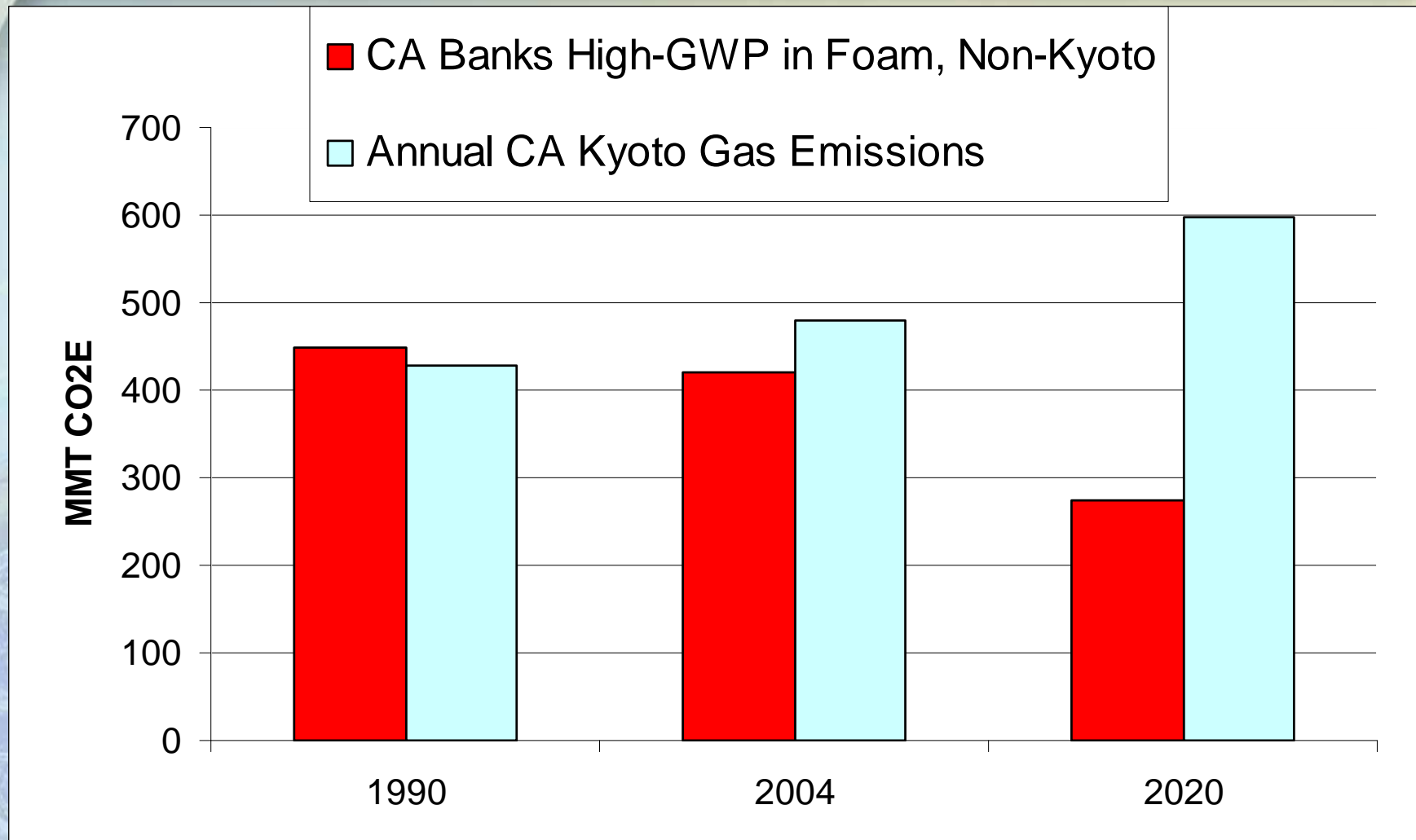
# Banks of High-GWP GHGs in Foam

## (Compared to all High-GWP GHG Sources)

- Major CA Bank Sources (all High-GWP GHGs) in 2006  
CA proportion of est. banks from USEPA, IPCC/TEAP
- HFCs ~ 80 MMTCO<sub>2</sub>E; ODSs ~ 700 MMTCO<sub>2</sub>E



# Banks of High-GWP GHGs in Foam

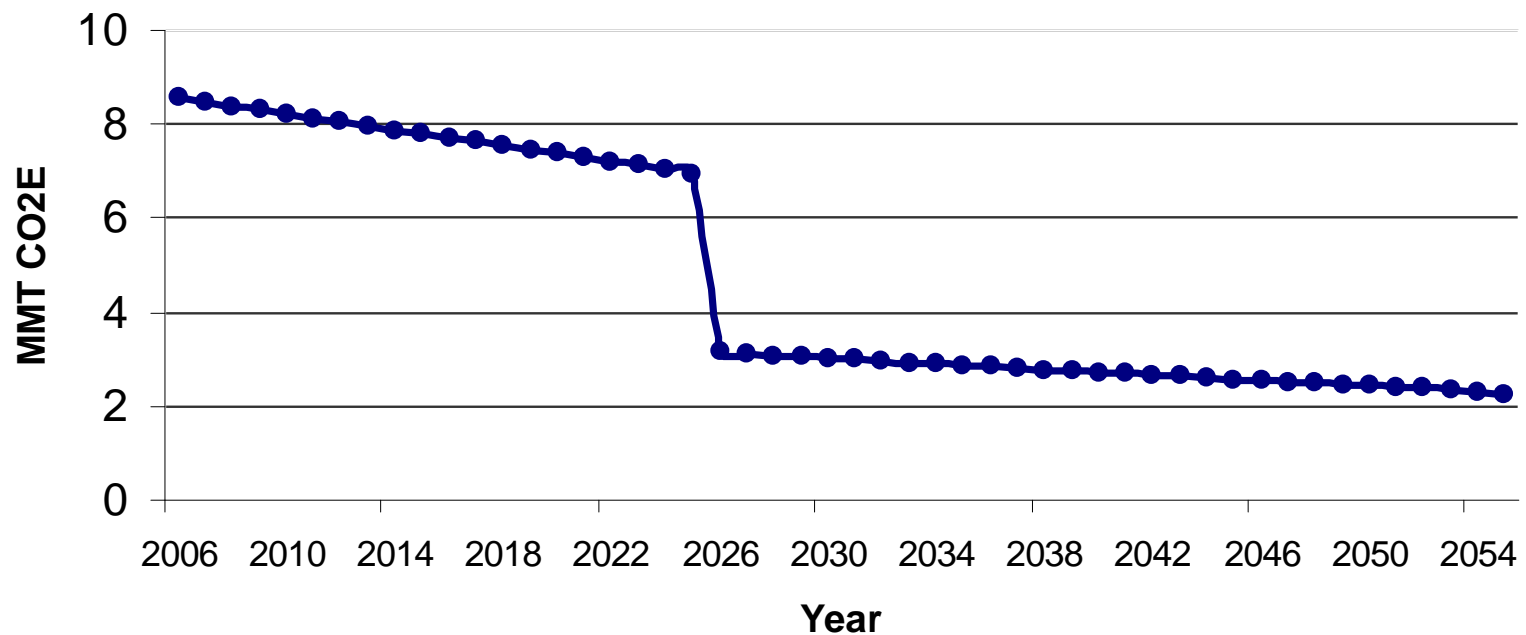




# Emissions and Trends - Annual

## Estimated Annual Emissions MMTCO<sub>2</sub>E from Banks of Existing Insulating Foam in California

(Significant Reduction in 20 Years after Appliances Reach End-of-Life)



Source: US EPA Vintaging Model and 50-year extrapolation

# Potential Control Strategies

- Voluntary
  - Continue existing appliance foam recovery program
  - Expand appliance foam recovery through incentives
  - Building foam insulation recovery prior to demolition, or post-demolition separation
  - Other sources of foam - options require additional research

## Potential Control Strategies (continued)

- Regulatory
  - Landfill ban on foam containing High-GWP GHGs
  - Recovery & Destruction required for end-of-life foam
  - Enforcement mechanisms not yet determined

## Research to Begin June 2008

- Foam Inventory and Emissions
  - Lead Contractor is Caleb Management Services
  - Inventory of Existing Banks, and Annual Emissions from foam sources (manufacturing through landfilled)
- Lifecycle Analysis of High-GWP GHGs
  - Cost and Feasibility of Recovery and Destruction Programs
  - Lead Contractor is ICF International

Preliminary Data Available by June 2009 for both projects

## Data Gaps

Additional information needed on foam gas emissions from landfills:

- Loss of foam gas at time of landfill or recycling (shredding/breakage loss)
- Biological attenuation/degradation rates
- Landfill gas capture rates
- ODS and HFC combustion efficiencies
- Toxic by-products of combustion



## Timeline (Estimated)

Summer 2008	Working Group/Stakeholder Consultation Meeting
Fall 2008	1st Public Workshop to Discuss Control Strategies and Options
Spring 2009	Working Group/Stakeholder Consultation Meeting
Summer 2009	2nd Public Workshop on Proposed Regulation
Winter 2009	Board Meeting on Action

# Contact Information

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## More Information

- Visit: <http://www.arb.ca.gov/cc/foam/foam.htm>
- See reports on foam and greenhouse gas emissions under “Archived Documents”